

What is claimed is:

1. A hybrid ferromagnet/ semiconductor spin device comprising:  
a semiconductor substrate;  
5 a source region formed on the substrate as a ferromagnet;  
a spin channel region on the substrate, where a spin-polarized carrier at  
the source region is injected and transported; and  
a drain region formed on the substrate as a ferromagnet, for detecting a  
spin which has passed through the spin channel region.  
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2. The hybrid ferromagnet/ semiconductor spin device of claim 1,  
wherein the ferromagnet is a magnet metal having a great spin polarization, and is  
one selected from Fe, Co, Ni, FeCo, and NiFe.
- 15 3. The hybrid ferromagnet/ semiconductor spin device of claim 1,  
wherein the ferromagnet is one selected from GaMnAs, InMnAs, GeMn, and  
GaMnN.
4. The hybrid ferromagnet/ semiconductor spin device of claim 1,  
20 wherein the ferromagnet is a half metal having a spin polarization of 100% such as  
CrO<sub>2</sub>.
5. The hybrid ferromagnet/ semiconductor spin device of claim 1,  
wherein the semiconductor is one selected from Si, GaAs, InAs, and Ge.

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6. The hybrid ferromagnet/ semiconductor spin device of claim 1, wherein the spin channel region is Si on insulator (SOI) or two dimensional electron gas of a compound semiconductor.

5 7. The hybrid ferromagnet/ semiconductor spin device of claim 1, wherein the source region and the drain region have a line width of a range of 5-1000nm.

8. The hybrid ferromagnet/ semiconductor spin device of claim 7;  
10 wherein an interval between the source region and the drain region is in a range of 10nm -1 $\mu$ m.

9. The hybrid ferromagnet/ semiconductor spin device of claim 7, wherein the source region and the drain region have a different line width each  
15 other so that a spin switching is anti-parallel in a certain magnet field range.

10. The hybrid ferromagnet/ semiconductor spin device of claim 1, wherein a surface of the semiconductor substrate where the source region and the drain region are formed is etched with a depth of a range of 10-500nm.

20 11. The hybrid ferromagnet/ semiconductor spin device of claim 1, wherein a contact resistance between the ferromagnet and the semiconductor is Ohmic or Schottky.

25 12. The hybrid ferromagnet/ semiconductor spin device of claim 1,

wherein  $\text{Al}_2\text{O}_3$  or  $\text{AlN}$  is inserted between the ferromagnet and the semiconductor as an intermediate film with a thickness of a range of 0.5-2nm thereby to generate a spin injection by a tunneling.

5           13.     A spin-polarized field effect transistor comprising a gate, an insulating layer formed under the gate, a source region and a drain region formed at left and right sides of the insulating layer by using a ferromagnet, and two dimensional electron gas below the insulating layer, wherein a precession of a spin-polarized carrier is controlled by a voltage applied to the gate.

10           14.     A fabrication method of a hybrid ferromagnet/ semiconductor spin device comprising the steps of:

              forming a channel region where a carrier transportation is performed on a semiconductor substrate;

15           etching a surface of the semiconductor substrate of right and left sides of the channel region with a depth of a range of 10-500nm;

              forming a source region and a drain region with a ferromagnet at the etched regions of the left and right sides of the channel region; and

              applying a magnetic field to the ferromagnet source region and the drain  
20           region and performing a thermal processing.

              15.     The method of claim 14, wherein the thermal processing is performed by applying a magnetic field of 0.5-5 kOe in a long axis direction of the ferromagnet at a vacuum state with a temperature of 100-500°C for 10-60 minutes.